CONODONTS FROM THE UPPER PERMIAN TYPE STRATA OF EUROPEAN RUSSIA

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Conodonts have been derived from the marine shallow-water deposits of the Kazanian Stage and contain the multielement species of *Sweetina*, *Merrillina* and *Stepanovites*. On the base of the occurrence of *Sweetina triticum* Wardlaw & Collinson, 1986 the Lower Kazanian substage may be compared with the uppermost Roadian and Lower Wordian deposits of North America. The Upper Kazanian substage containing *Merrillina divergens*? (Bender & Stoppel, 1965) and *Stepanovites meyeni* Kozur & Movšovič, 1975 may be correlated with the Upper Wordian, and possibly with the lowermost Capitanian.

CONODONT study in the Upper Permian stratotype sections was conducted by the authors during the last three years. Conodonts have been recovered from the marine shallow-water Kazanian deposits, predominantly from limestones and dolomites which commonly contain pelecypods and brachiopods. The weight of samples studied for deriving the conodonts from the outcrops was about 50–100 kg and from coreholes was 1 kg. Conodont faunas of the Kazanian Stage contain the multielement apparatuses consisting of a spathognathiform element (Pa), an ozarkodiniform element (Pb), a three-limbed hibbardelliform element (Sa), a neoprioniodiniform element (M) and hindeodelliform elements (Sb, Sc). These elements have allowed us to determine the multielement species of *Sweetina*, *Merrillina* and *Stepanovites*.

The Lower Kazanian in the type area consists of grey marine carbonate and terrigenous deposits about 60 m thick. Conodont faunas were recovered from the limestones of the lower part of the succession (Baitugan bed) from seven outcrops and seven boreholes (Figs 1, 2). The set of the elements has allowed us to define in this part of the section the multielement apparatuses of *Sweetina triticum* Wardlaw & Collinson, 1986 (Figs 3A–Q, 4A–H). It is possible that this stratigraphic interval contains some new species of *Sweetina* and *Merrillina*, however for the evidence of such conclusion the additional material is required.

The Upper Kazanian substage, in the investigated sections of the stratotype area, is about 60 m thick and consists of grey, predominantly marine carbonate and carbonate-terrigenous deposits. Conodont faunas were recovered from dolomitic limestones containing diverse marine invertebrates from three outcrops and one borehole. The allocated complex of conodont elements has allowed us to establish two species: *Merrillina divergens*? (Bender & Stoppel, 1965) (Figs 4I–X, 5A–E) and *Stepanovites meyeni* Kozur & Movšovič, 1975 (Figs 5F–V, 6A–O). In the majority of the samples these species were determined together, therefore the assumption about probable generic unity of these two genera and species (Swift 1986) should not be excluded.

DISCUSSION

Sweetina triticum Wardlaw & Collinson is widespread in marine shallow-water deposits of the Roadian and Lower Wordian of North America (Wardlaw & Collinson 1986; Kozur 1995). *Merrillina divergens* (Bender & Stoppel) is widespread in the Zechstein deposits of Germany, Great Britain and Poland (Bender & Stoppel 1965; Jordan 1969; Szaniawski 1969; Swift & Aldridge 1982, 1985; Swift 1986). Wardlaw & Collinson (1986) on the basis of a study of the conodonts from the Phosphoria Formation have established the stratigraphic range of this species within the Upper Wordian and lowermost Capitanian. *Stepanovites meyeni* Kozur & Movšovič was described for the first time by Kozur (1975) from the Upper Kazanian deposits of the north of the East-European platform. The discovery of this species allowed Kozur to compare the Upper Kazanian with the Lower Capitanian of North America. Afterwards he has revised the interval of the distribution of this species and concluded that *Stepanovites meyeni* is characteristic for the Upper Roadian and Lower Wordian shallow-water deposits of the Boreal realm including Cis-Urals (Kozur 1995).

In our opinion, on the basis of the occurrence of *Sweetina triticum* Wardlaw & Collinson, the Lower Kazanian of the East-European platform can be compared with the uppermost Roadian and Lower Wordian. The Upper Kazanian containning *Merrillina divergens* (Bender & Stoppel) and *Stepanovites meyeni* Kozur & Movšovič may be correlated with the Upper Wordian, and possibly the lowermost Capitanian.

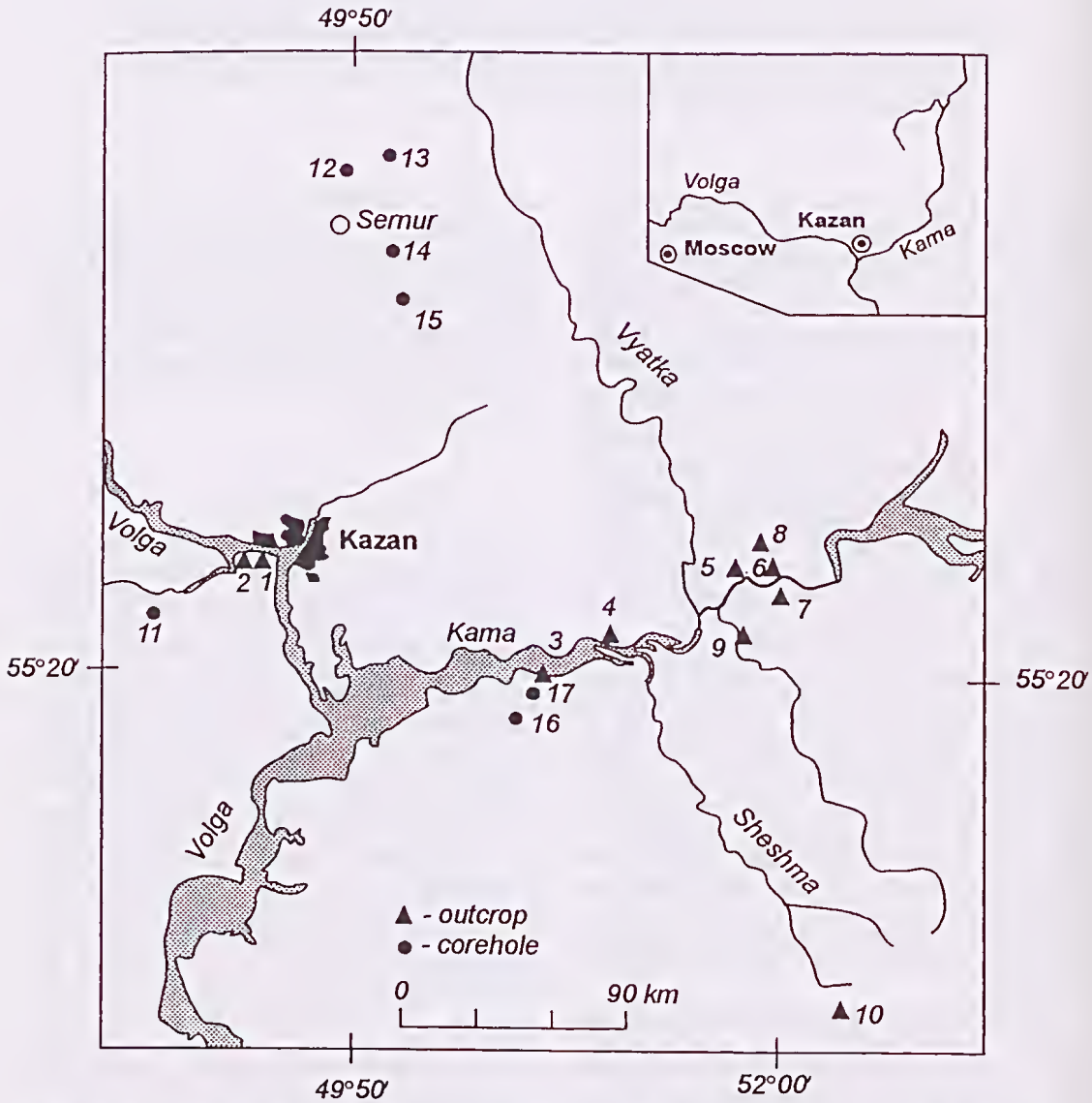

Fig. 1. Localities yielding samples of Upper Permian conodonts. Stratotype and main sections of the Kazanian Stage: 1—Pechischi; 2—Morkvashi; 3—Chistopol; 4—Bersut; 5—Sentyak; 6—Elabuga; 7—Prosti; 8—Kolosovka; 9—Borok; 10—Kamischla.

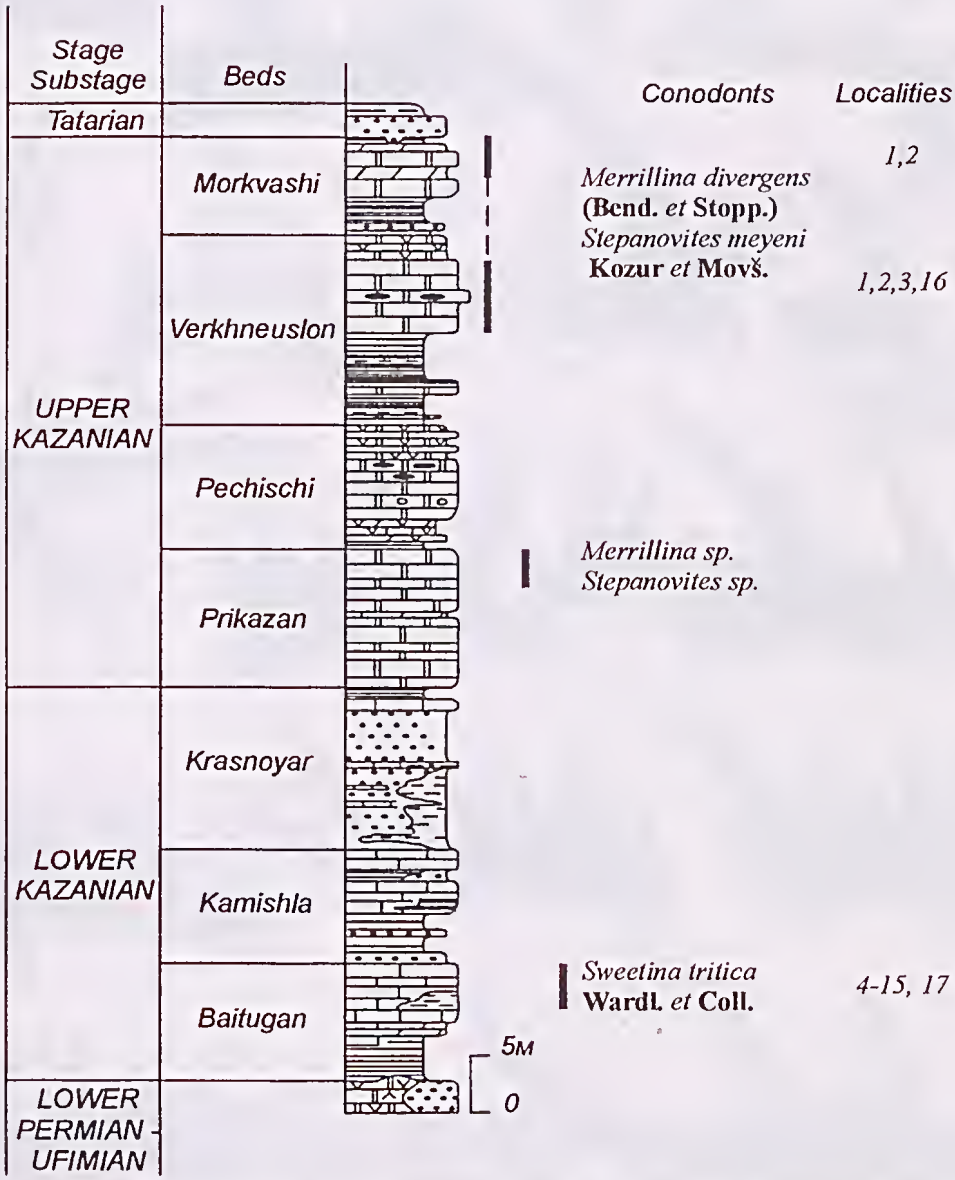

Fig. 2. Distribution of conodonts in the Kazanian Stage of the type area and stratigraphic position of the conodont localities.

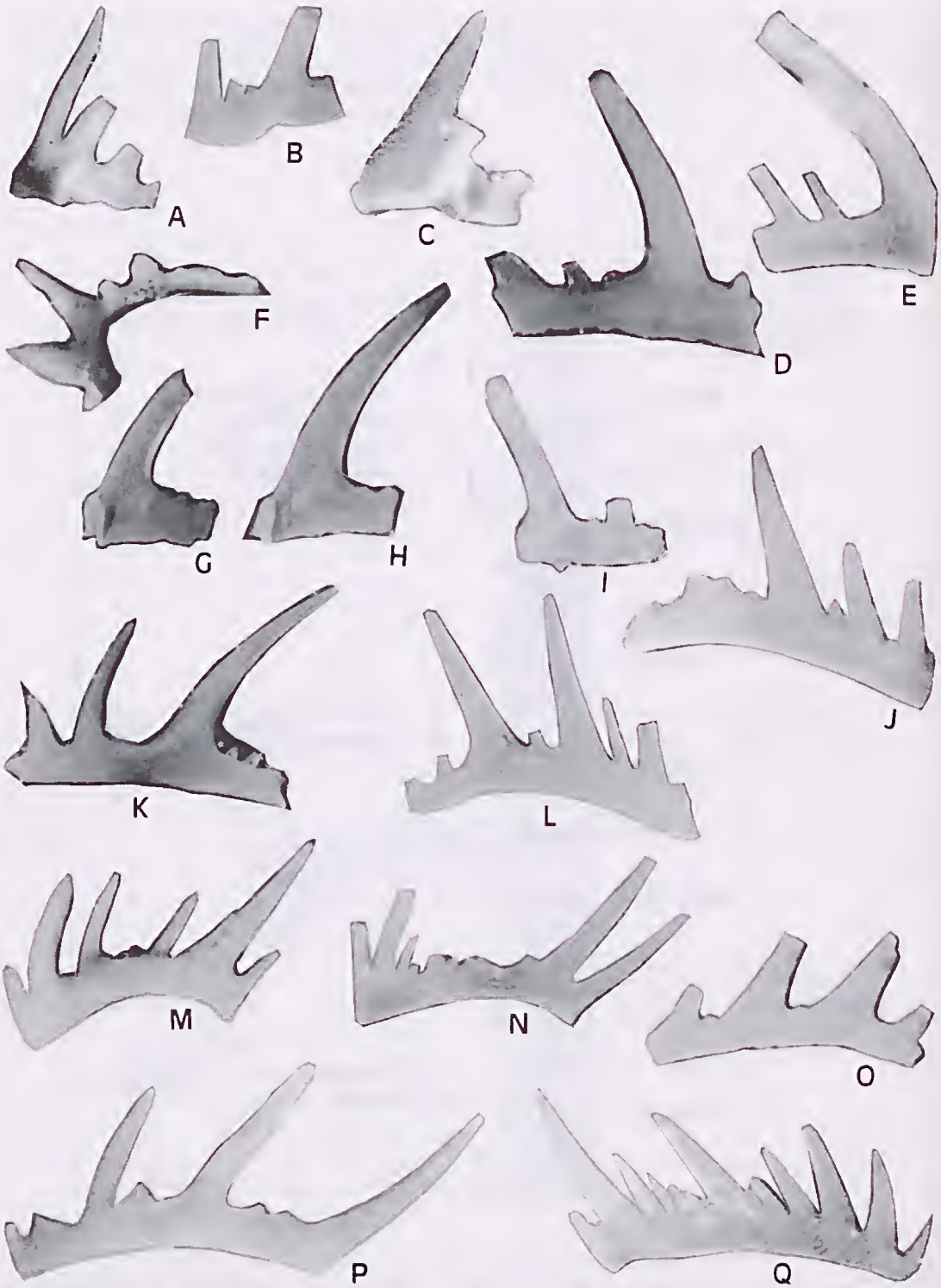

Fig. 3 (see legend on page 144)

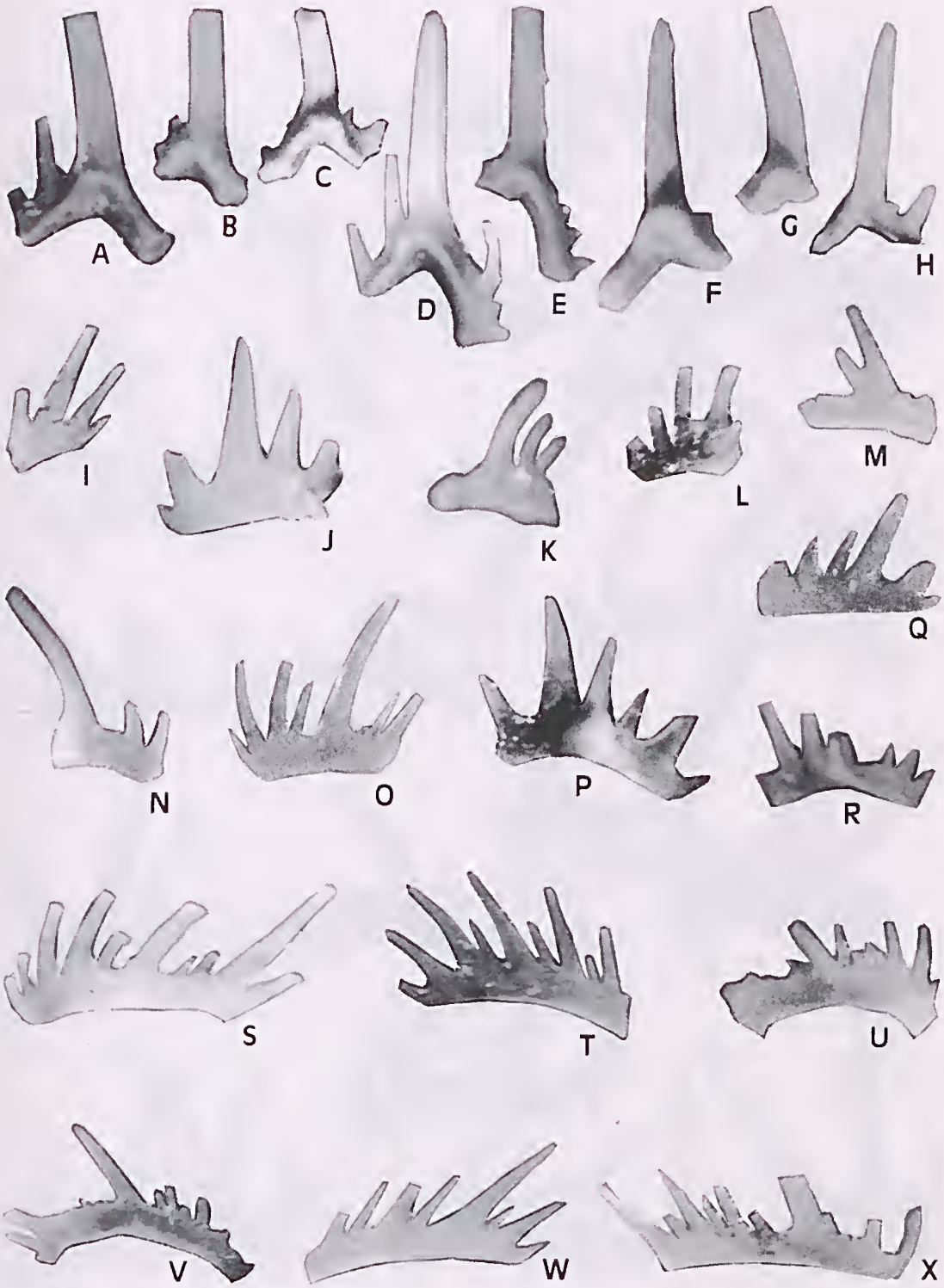

Fig. 4 (see legend on page 144)

Fig. 5 (see legend on page 144)

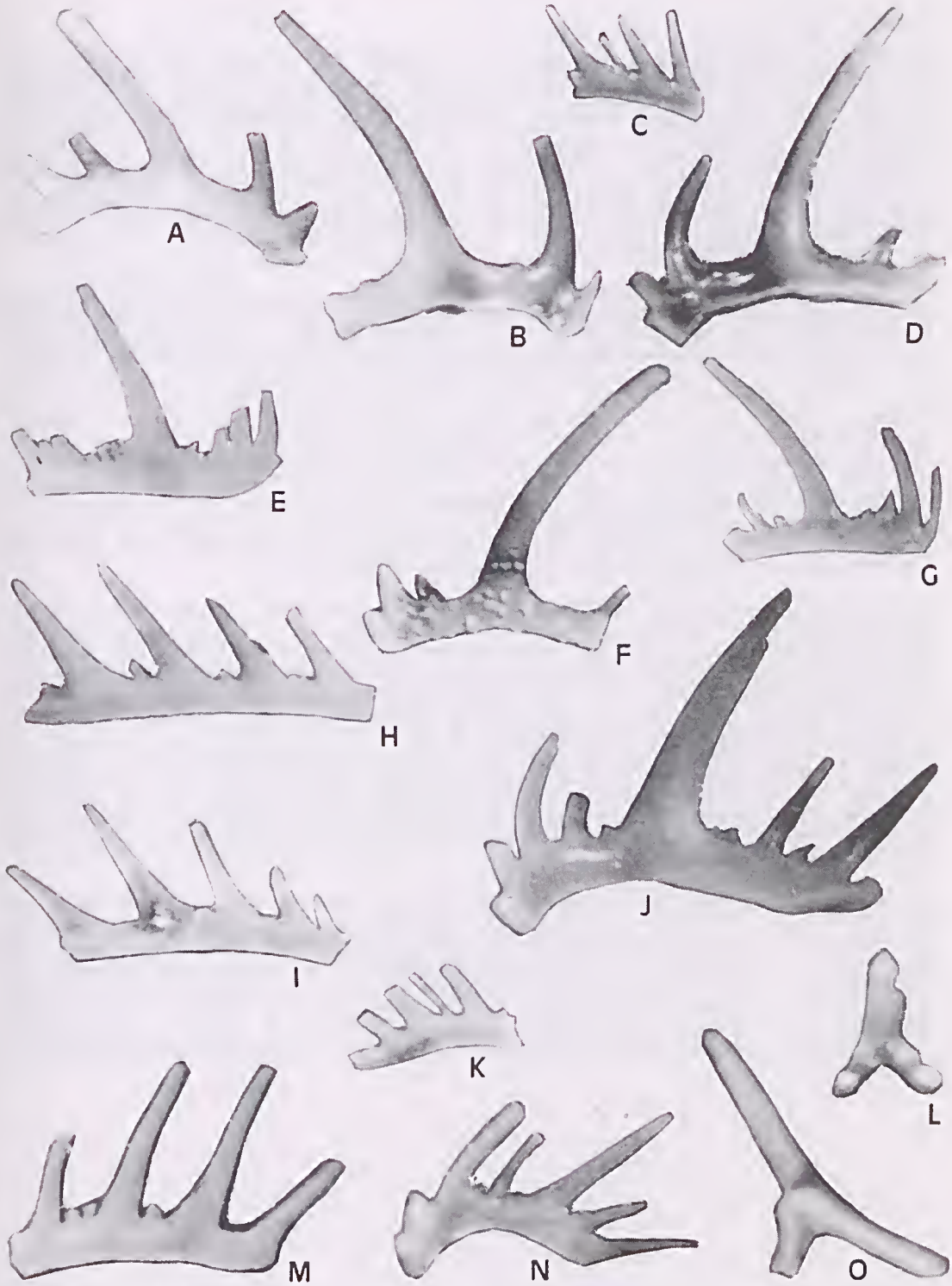

Fig. 6 (see legend on page 144)

Legends to Figs 3–6.

Fig. 3. Sweetina triticum Wardlaw & Collinson, 1986 (all views ×55). A, lateral view, Pa element, GM KSU 40/101, loc. 5. B, lateral view, Pa element, GM KSU 40/102, loc. 5. C, lateral view, Pa element, GM KSU 40/103, loc. 14. D, posterolateral view, Pb element, GM KSU 40/104, loc. 5. E, posterolateral view, Pb element, GM KSU 40/105, loc. 14. F, dorsal view, Sa element, GM KSU 40/106, loc. 6. G, lateral view, Sa element, GM KSU 40/107, loc. 5. H, lateral view, Sa element, GM KSU 40/108, loc. 5. I, lateral view Sa element, GM KSU 40/109, loc. 6. J, lateral view, Sc element, GM KSU 40/112, loc. 5. K, lateral view, Sc element, GM KSU 40/110, loc. 6. L, lateral view, Sc element, GM KSU 40/111, loc. 8. M, lateral view, Sb element, GM KSU 40/113, loc. 8. N, lateral view, Sb element, GM KSU 40/114, loc. 5. O, lateral view, Sb element, GM KSU 40/115, loc. 6. P, lateral view, Sb element, GM KSU 40/116, loc. 8. Q, lateral view, Sb element, GM KSU 40/117, loc. 8.

Fig. 4. A–H, *Sweetina triticum* Wardlaw & Collinson, 1986 (all views ×55). A, posterior view, M element, GM KSU 40/118, loc. 5. B, posterior view, M element, GM KSU 40/119, loc. 5. C, posterior view, M element, GM KSU 40/120, loc. 5. D, posterior view, M element, GM KSU 40/121, loc. 14. E, posterior view, M element, GM KSU 40/122, loc. 5. F, posterior view, M element, GM KSU 40/123, loc. 9. G, posterior view, M element, GM KSU 40/124, loc. 9. H, posterior view, M element, GM KSU 40/125, loc. 6. I–X, *Merrillina divergens*? (Bender & Stoppel, 1965) (all views ×55). I, inner view, Pa element, GM KSU 40/126, loc. 1. J, inner view, Pa element, GM KSU 40/127, loc. 1. K, inner view, Pa element, GM KSU 40/128, loc. 1. L, inner view, Pa element, GM KSU 40/129, loc. 2. M, lateral view, Pb element, GM KSU 40/130, loc. 1. N, posterior view, Sa element, GM KSU 40/133, loc. 1. O, lateral view, Pb element, GM KSU 40/132, loc. 1. P, anterolateral view, Sa element, GM KSU 40/134, loc. 2. Q, lateral view, Pb element, GM KSU 40/131, loc. 1. R, anterolateral view, Sa element, GM KSU 40/135, loc. 1. S, posterolateral view, Sb element, GM KSU 40/136, loc. 1. T, posterolateral view, Sc element, GM KSU 40/137, loc. 1. U, posterolateral view, Sb element, GM KSU 40/142, loc. 1. V, posterolateral view, Sb element, GM KSU 40/141, loc. 1. W, posterolateral view, Sc element, GM KSU 40/138, loc. 1. X, posterolateral view, Sc element, GM KSU 40/140, loc. 1.

Fig. 5. A–E, *Merrillina divergens*? (Bender & Stoppel, 1965) (all views ×55). A, lateral view, Sc element, GM KSU 40/143, loc. 1. B, lateral view, Sc element, GM KSU 40/144, loc. 1. C, posterior view, M element, GM KSU 40/147, loc. 1. D, posterior view, M element, GM KSU 40/146, loc. 1. E, lateral view, Sc element, GM KSU 40/145, loc. 1. F–V, *Stepanovites meyeni* Kozur & Movšovič, 1975 (all views ×55). F, lateral view, Pb element, GM KSU 40/148, loc. 1. G, lateral view, Pb element, GM KSU 40/149, loc. 1. H, posterior view, Sa element, GM KSU 40/150, loc. 1. I, lateral view, Sa element, GM KSU 40/151, loc. 1. J, lateral view, Sc element, GM KSU 40/156, loc. 8. K, lateral view, Sc element, GM KSU 40/155, loc. 8. L, lateral view, Sb element, GM KSU 40/152, loc. 1. M, lateral view, Sc element, GM KSU 40/153, loc. 1. N, lateral view, Sb element, GM KSU 40/154, loc. 1. O, lateral view, Pb element, GM KSU 40/157, loc. 1. P, lateral view, Pb element, GM KSU 40/160, loc. 2. Q, lateral view, Pb element, GM KSU 40/158, loc. 2. R, lateral view, Pb element, GM KSU 40/159, loc. 2. S, posterior view, Sa element, GM KSU 40/162, loc. 1. T, anterior view, Sa element, GM KSU 40/161, loc. 2. U, lateral view, Sc element, GM KSU 40/163, loc. 2. V, lateral view, Sc element, GM KSU 40/164, loc. 2.

Fig. 6. Stepanovites meyeni Kozur & Movšovič, 1975 (all views ×55). A, lateral view, Sc element, GM KSU 40/165, loc. 2. B, lateral view, Sb element, GM KSU 40/166, loc. 2. C, lateral view, Sc element, GM KSU 40/176, loc. 1. D, lateral view, Sb element, GM KSU 40/167, loc. 2. E, lateral view, Sb element, GM KSU 40/169, loc. 1. F, lateral view, Sc element, GM KSU 40/170, loc. 2. G, lateral view, Sc element, GM KSU 40/171, loc. 1. H, lateral view, Sc element, GM KSU 40/172, loc. 1. I, lateral view, Sc element, GM KSU 40/173, loc. 2. J, lateral view, Sb element, GM KSU 40/168, loc. 2. K, lateral view, Sc element, GM KSU 40/175, loc. 1. L, anterior view, M element, GM KSU 40/178, loc. 2. M, lateral view, Sb element, GM KSU 40/174, loc. 2. N, lateral view Sc element, GM KSU 40/177, loc. 2. O, posterior view, M element, GM KSU 40/179, loc. 2.

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